

REMARKS

Entry of the foregoing amendments after final rejection as narrowing the issues and presenting the claims in condition for allowance is respectfully solicited. The foregoing amendments after final rejection have not been earlier presented because of the newly cited references and new grounds for rejection.

Claims 1-6, 8-11 and 19 are pending and at issue in the application with claims 1 and 19 being the independent claims. Reconsideration and withdrawal of the rejections in view of the remarks below is respectfully requested.

Submitted herewith is a Terminal Disclaimer pursuant to 37 CFR 1.321(c) as executed by James P. Zeller (Reg. No. 28,491), the attorney of record in the present application. In view of the Terminal Disclaimer submitted herewith, it is respectfully submitted that the rejection of claims 1-5 and 19 as unpatentable over U.S. Patent No. 6,432,750 under the judicially created doctrine of obviousness-type double patenting has been overcome and should be withdrawn.

Each of claims 1-6 and 8-11 recites a semiconductor power module that includes a heat sink comprising a compound of at least one of AlN and BeO. The heat sink directly contacts a lead frame, includes an electrical insulating property and thermal conductivity, and has a surface exposed to the outside of the semiconductor power module.

Claim 19 recites a semiconductor power module that includes a heat sink consisting of Al₂O₃. The heat sink directly contacts a lead frame, includes an electrical insulating property and thermal conductivity, and has a surface exposed to the outside of the semiconductor power module.

Claims 1-2, 4, 10 and 11 were rejected as anticipated by Hamzehdoost et al. (U.S. Pat. No. 5,430,331). Claim 19 was rejected as unpatentable over Hamzehdoost et al. Claims 3, 5 and 11 were rejected as unpatentable over Hamzehdoost et al. in view of Majumdar et al. (U.S. Pat. 5,703,399). Claim 6 was rejected as unpatentable over Hamzehdoost et al. in view of McCarthy et al. (U.S. Pat. 3,956,726). Claim 8 was rejected as unpatentable over

Hamzehdoost et al. in view of Tomita et al. (U.S. Pat. No. 5,440,169). Claim 9 was rejected as unpatentable over Hamzehdoost et al. and Tomita et al. further in view of Majumdar et al. The applicants respectfully traverse the rejections.

The applicants respectfully submit that claim 1 is not anticipated by Hamzehdoost et al., because Hamzehdoost et al. does not teach each and every element of claim 1. In particular, Hamzehdoost et al. does not teach or suggest a heat sink comprising AlN and/or BeO which has a surface exposed to the outside of the power module. Instead, Hamzehdoost et al. discloses that thermally conductive substrates formed of AlN are not exposed to the outside of the module. For example, Hamzehdoost et al. discloses a thermally conductive substrate (130, 144) formed of aluminum nitride material. (Hamzehdoost et al., col. 6, lines 20-34; col. 7, lines 30-37 and lines 53-61; col. 9, lines 17-26; Figs. 6, 9A, 10, 14A). In each example having a substrate formed of aluminum nitride, Hamzehdoost et al. discloses the substrate is entirely encased in plastic molding. By contrast, Hamzehdoost et al. discloses a thermally conductive slug (138, 146) formed of copper which has an exposed surface. (Hamzehdoost et al., col. 6, line 67 to col. 7, line 10; col. 7, lines 37-39; col. 9, lines 17-23; Figs. 8, 9B, 14B). Accordingly, Hamzehdoost et al. teaches a distinct difference between aluminum nitride and copper, namely that Hamzehdoost et al. only allows copper slugs to have an exposed surface (see Figs. 8, 9B, 14B), as specifically teaches away from aluminum nitride substrates having an exposed surface (see Figs. 6, 9A, 10, 14A). As such, Hamzehdoost et al. does not disclose or suggest a heat sink formed of AlN and/or BeO which has a surface exposed to the outside of the power module, as recited by claim 1.

Additionally, Hamzehdoost et al. does not recognize the advantages of exposing a heat sink made of AlN or BeO to the outside of a semiconductor module. As discussed above, Hamzehdoost et al. discloses a thermally conductive substrate formed of an aluminum nitride material, but which does not include an exposed surface. As such, Hamzehdoost et al. does not recognize the advantage of increased thermal dissipation associated with a heat sink formed of AlN or BeO and which has a surface exposed to the outside of a semiconductor module, as recited by claim 1.

Therefore, claim 1 is not anticipated or rendered obvious by Hamzehdoost et al. Moreover, as claim 1 is allowable over the art of record, claims 2, 4 and 10 are allowable as being dependent on claim 1.

The applicants further respectfully submit that claim 19 is not unpatentable over Hamzehdoost et al. In particular, the official action does not establish a *prima facie* case of obviousness because Hamzehdoost et al. teaches away from the combination. As explained above, Hamzehdoost et al. specifically teaches away from exposing a surface of a thermally conductive substrate formed of aluminum nitride. Because Hamzehdoost et al. discloses that other ceramic-type substrate materials similar to aluminum nitride may be suitable (see col. 6, lines 23-26, the teachings of Hamzehdoost et al. with respect to aluminum nitride are also applicable to any similar materials suggested by Hamzehdoost et al. Accordingly, Hamzehdoost et al. teaches away from exposing a surface of a thermally conductive substrate which may be formed of materials similar to aluminum nitride. One of ordinary skill in the art would therefore not be motivated by Hamzehdoost et al. to provide a heat sink consisting of Al_2O_3 which has a surface exposed to the outside of the semiconductor module, as recited by claim 1, because Hamzehdoost et al. teaches away from such a combination.

Further, as admitted in the official action, Hamzehdoost et al. does not disclose a heat sink consisting of Al_2O_3 alone. The official action merely states that selection of a known material based on its suitability for its intended use may be used to support a *prima facie* case of obviousness. However, the official action has not produced prior art disclosing a heat sink comprising Al_2O_3 , or otherwise demonstrated that the art recognizes the suitability of using Al_2O_3 as a heat sink material. Accordingly, if use of Al_2O_3 as a heat sink material is an intended use within the knowledge generally available to one of ordinary skill in the art, the applicants respectfully request production of authority supporting such a statement. See MPEP 2144.03. Otherwise, it is clear that a *prima facie* case of obviousness cannot be established where all the limitations of a claimed combination are not taught or suggested by the prior art. See *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974). See also MPEP 2143.03.

Appl. No. 09/677,558

Amdt. dated January 4, 2006

Reply to final official action of October 4, 2005

Likewise, none of Majumdar et al., McCarthy et al. or Tomita et al. discloses or suggests a heat sink comprising AlN and/or BeO, or consisting of Al₂O₃, which directly contacts a lead frame and has a surface exposed to the outside of the power module.

Therefore, none of Majumdar et al., McCarthy et al. or Tomita et al., either alone or in combination with Hamzehdoost et al., renders any of claims 1-6, 8-11 and 19 obvious.

CONCLUSION

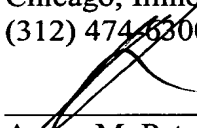
Accordingly, the applicants respectfully submit that all pending claims are patentable over the art of record and should be allowed. In the light of the foregoing, prompt issuance of a notice of allowance is respectfully solicited.

Should the examiner have any questions, she is respectfully invited to telephone the undersigned.

Respectfully submitted,

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January 4, 2006